

$V_{RRM} = 4500 \text{ V}$
 $I_{F(AV)M} = 1200 \text{ A}$
 $I_{FSM} = V_{(T0)} = 25 \times 10^3 \text{ A}$
 $= r_T = 1.3 \text{ V}$
 $= 0.48 \text{ mW}$
 $V_{DC-link} = 2800 \text{ V}$

Fast Recovery Diode

5SDF 13H4501

Doc. No. 5SYA1104-02 Oct. 06

- Patented free-floating silicon technology
- Low on-state and switching losses
- Optimized for use as freewheeling diode in GTO converters with high DC link voltages
- Industry standard housing
- Cosmic radiation withstand rating

Blocking

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	Value	Unit
Repetitive peak reverse voltage	V_{RRM}	$f = 50 \text{ Hz}$, $t_p = 10 \text{ ms}$, $T_{vj} = 125^\circ\text{C}$	4500	V
Permanent DC voltage for 100 FIT failure rate	$V_{DC-link}$	Ambient cosmic radiation at sea level in open air. (100% Duty)	2800	V

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Repetitive peak reverse current	I_{RRM}	$V_R = V_{RRM}$, $T_{vj} = 125^\circ\text{C}$			50	mA

Mechanical data

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Mounting force	F_m		36	40	44	kN
Acceleration	a	Device unclamped			50	m/s^2
Acceleration	a	Device clamped			200	m/s^2

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Weight	m				0.83	kg
Housing thickness	H		26.0		26.4	mm
Surface creepage distance	D_s		30			mm
Air strike distance	D_a		20			mm

Note 1 Maximum rated values indicate limits beyond which damage to the device may occur

On-state

Maximum rated values ¹⁾

Parameter	Symbol	Conditions	min	typ	max	Unit
Max. average on-state current	$I_{F(AV)M}$	Half sine wave, $T_C = 85^\circ\text{C}$			1200	A
Max. RMS on-state current	$I_{F(RMS)}$				1900	A
Max. peak non-repetitive surge current	I_{FSM}	$t_p = 10\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_R = 0\text{ V}$			25×10^3	A
Limiting load integral	I^2t				3.13×10^6	A ² s
Max. peak non-repetitive surge current	I_{FSM}	$t_p = 1\text{ ms}$, $T_{vj} = 125^\circ\text{C}$, $V_R = 0\text{ V}$			60×10^3	A
Limiting load integral	I^2t				1.8×10^6	A ² s

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
On-state voltage	V_F	$I_F = 2500\text{ A}$, $T_{vj} = 125^\circ\text{C}$			2.5	V
Threshold voltage	$V_{(T0)}$	$T_{vj} = 125^\circ\text{C}$			1.3	V
Slope resistance	r_T	$I_F = 400 \dots 4000\text{ A}$			0.48	m Ω

Turn-on

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Peak forward recovery voltage	V_{FRM}	$di/dt = 500\text{ A}/\mu\text{s}$, $T_{vj} = 125^\circ\text{C}$			50	V

Turn-off

Characteristic values

Parameter	Symbol	Conditions	min	typ	max	Unit
Reverse recovery current	I_{RM}	$di/dt = 300\text{ A}/\mu\text{s}$, $I_{FQ} = 1000\text{ A}$,			800	A
Reverse recovery charge	Q_{rr}	$T_j = 125^\circ\text{C}$, $V_{RM} = 4500\text{ V}$,			3000	μC
Turn-off energy	E_{rr}	$C_S = 3\text{ }\mu\text{F}$ (GTO snubber circuit)			1.25	J

Thermal

Maximum rated values ^{Note 1}

Parameter	Symbol	Conditions	min	typ	max	Unit
Operating junction temperature range	T_{vj}		-40		125	$^\circ\text{C}$
Storage temperature range	T_{stg}		-40		125	$^\circ\text{C}$

Characteristic values

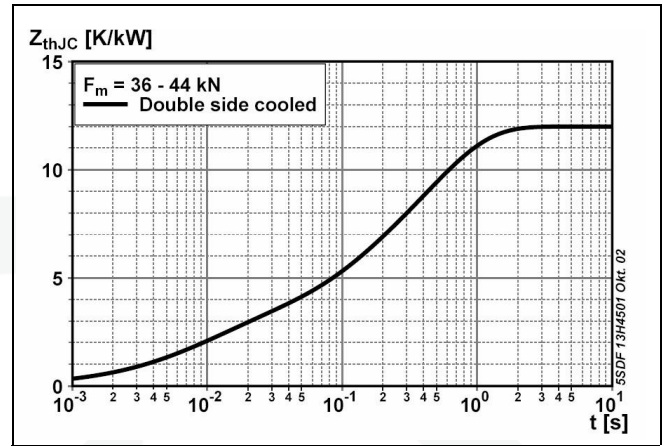
Parameter	Symbol	Conditions	min	typ	max	Unit
Thermal resistance junction to case	$R_{th(j-c)}$	Double-side cooled $F_m = 36 \dots 44\text{ kN}$			12	K/kW
	$R_{th(j-c)A}$	Anode-side cooled $F_m = 36 \dots 44\text{ kN}$			24	K/kW
	$R_{th(j-c)C}$	Cathode-side cooled $F_m = 36 \dots 44\text{ kN}$			24	K/kW
	$R_{th(c-h)}$	Double-side cooled $F_m = 36 \dots 44\text{ kN}$			3	K/kW

Thermal resistance case to heatsink	$R_{th(c-h)}$	Single-side cooled $F_m = 36...44 \text{ kN}$				6	K/kW
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Analytical function for transient thermal impedance:

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i	1	2	3	4
$R_{th i}(\text{K/kW})$	7.440	2.000	1.840	0.710
$\tau_i(\text{s})$	0.4700	0.0910	0.0110	0.0047



$$Z_{th(j-c)}(t) = \sum_{i=1} R_{th i} (1 - e^{-t/\tau_i})$$

Fig. 1 Transient thermal impedance junction-to-case

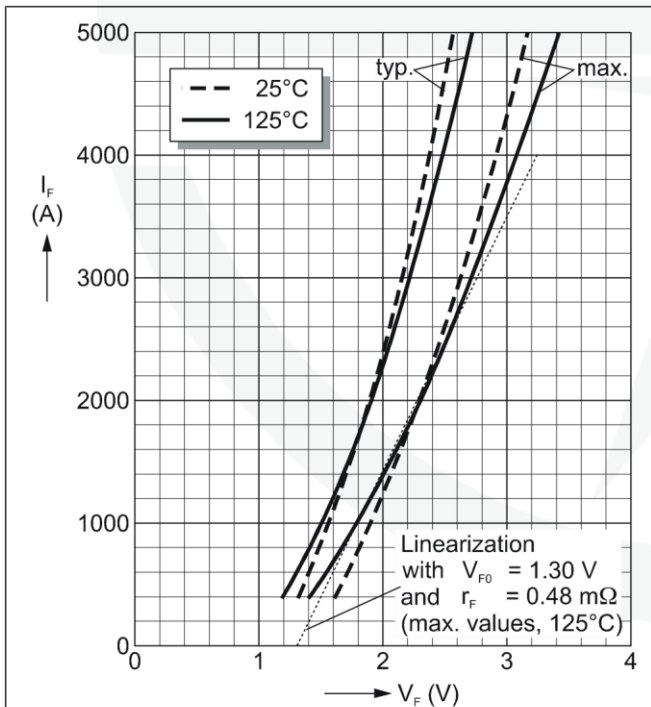


Fig. 2 Max. on-state voltage characteristics

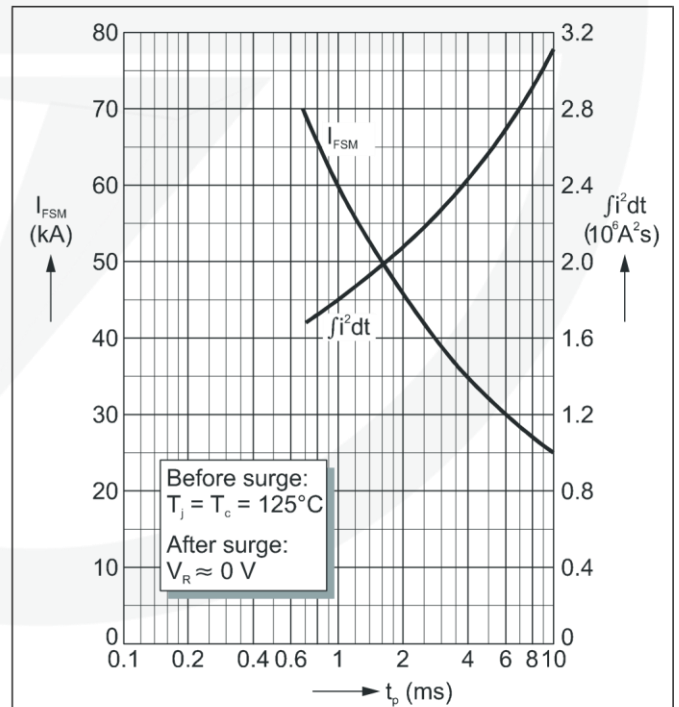


Fig. 3 Surge on-state current vs. pulse length. Half-sine wave

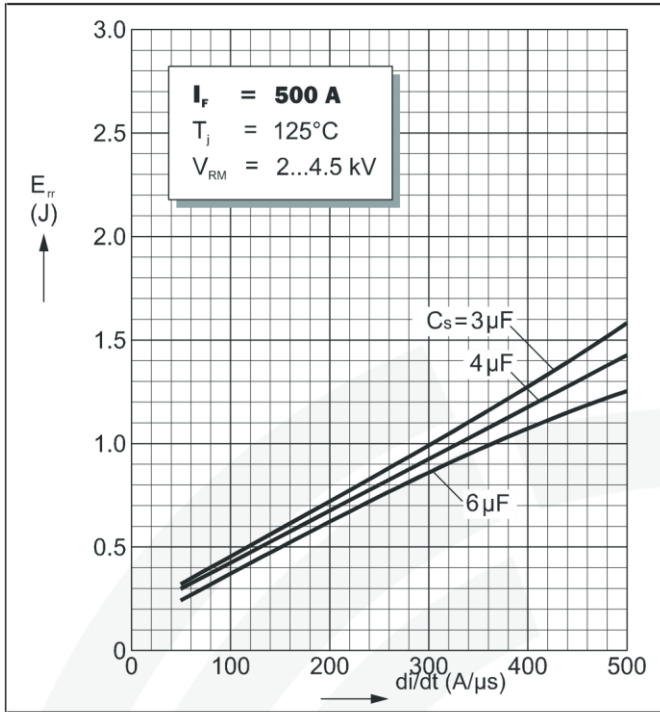


Fig. 4 Upper scatter range of turn-off energy per pulse vs. turn-off current

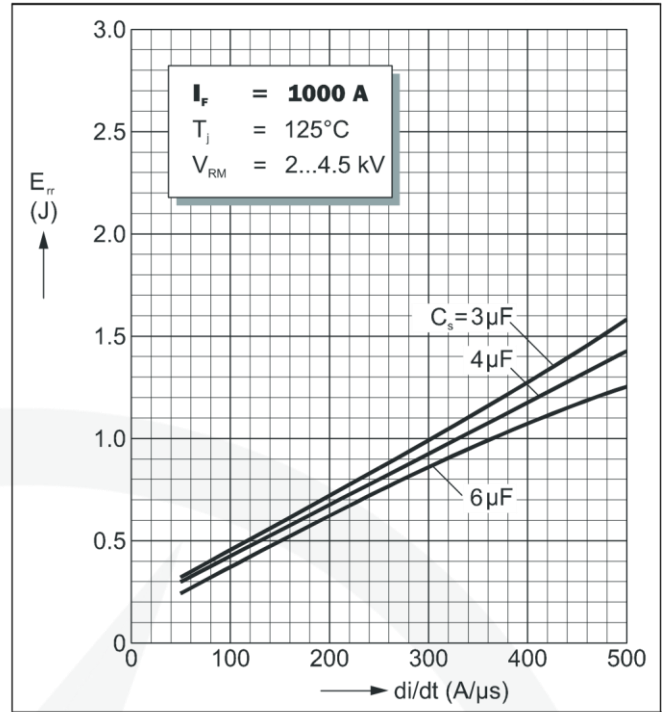


Fig. 5 Upper scatter range of turn-off energy per pulse vs. reverse current rise rate

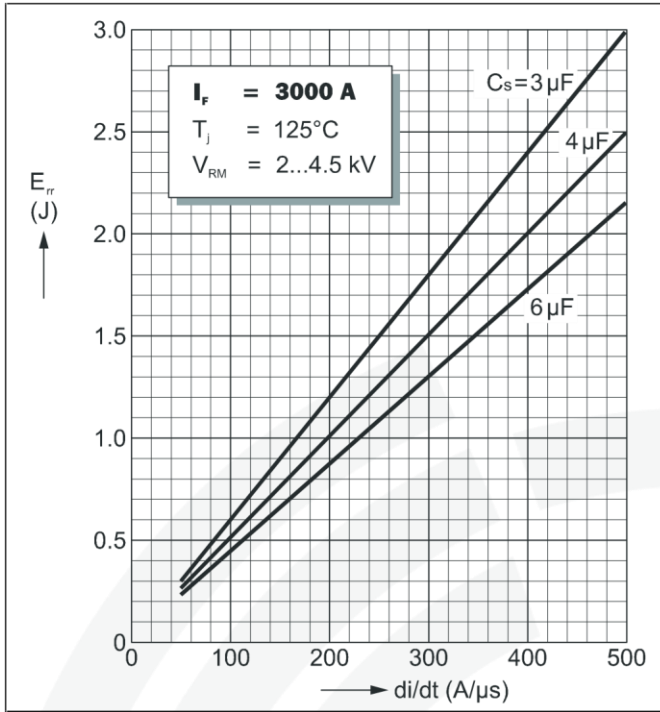


Fig. 6 Upper scatter range of turn-off energy per pulse vs reverse current rise rate

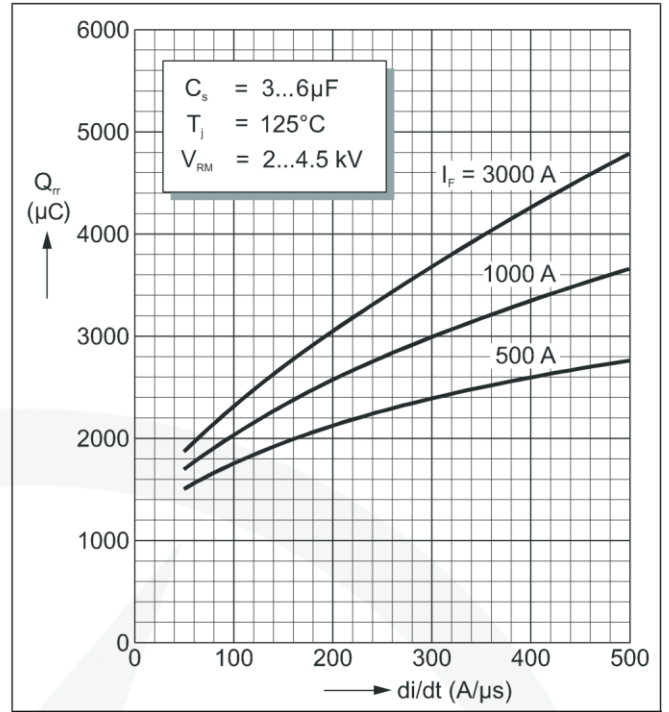


Fig. 7 Upper scatter range of repetitive reverse recovery charge vs reverse current rise rate.

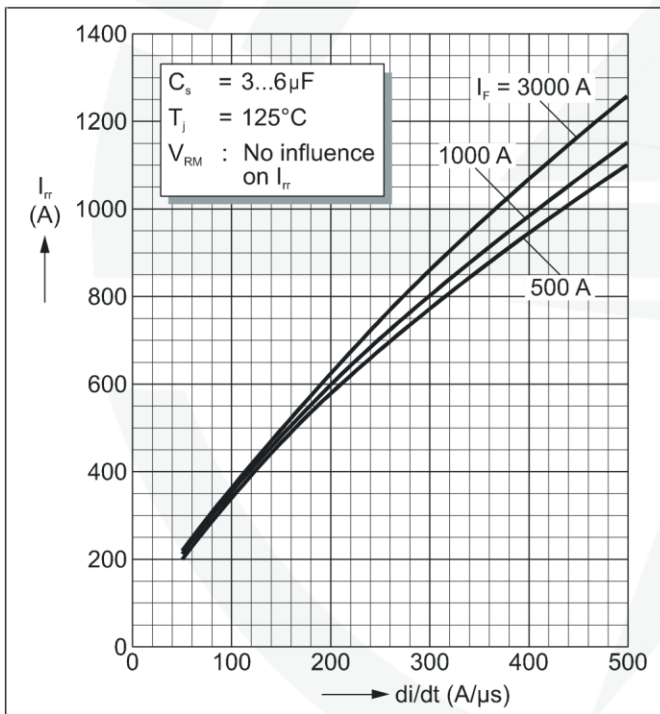


Fig. 8 Upper scatter range of reverse recovery current vs reverse current rise rate

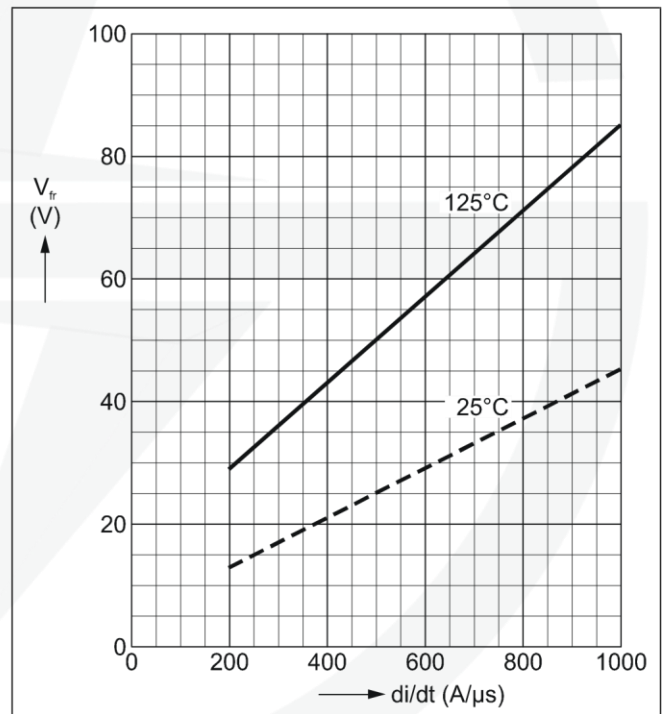


Fig. 9 Forward recovery vs. Turn on di/dt (max. values)

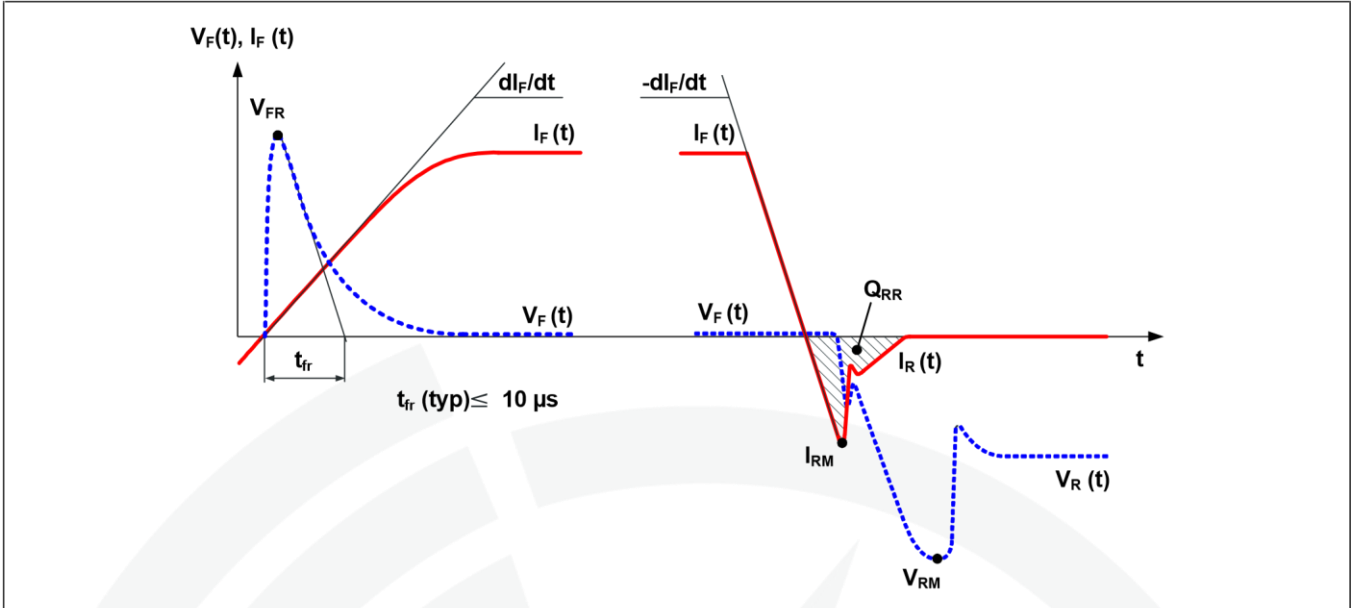


Fig. 10 General current and voltage waveforms

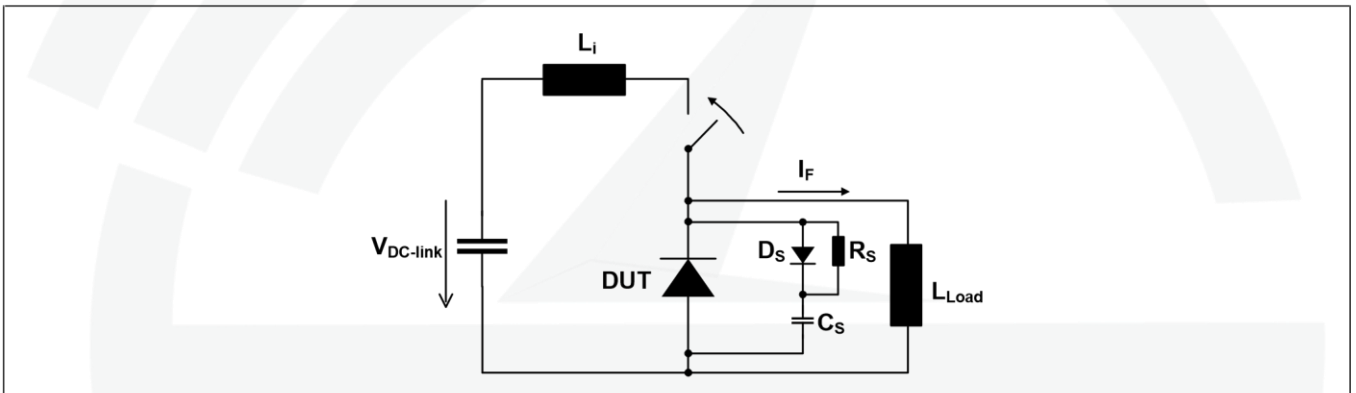


Fig. 11 Test circuit.

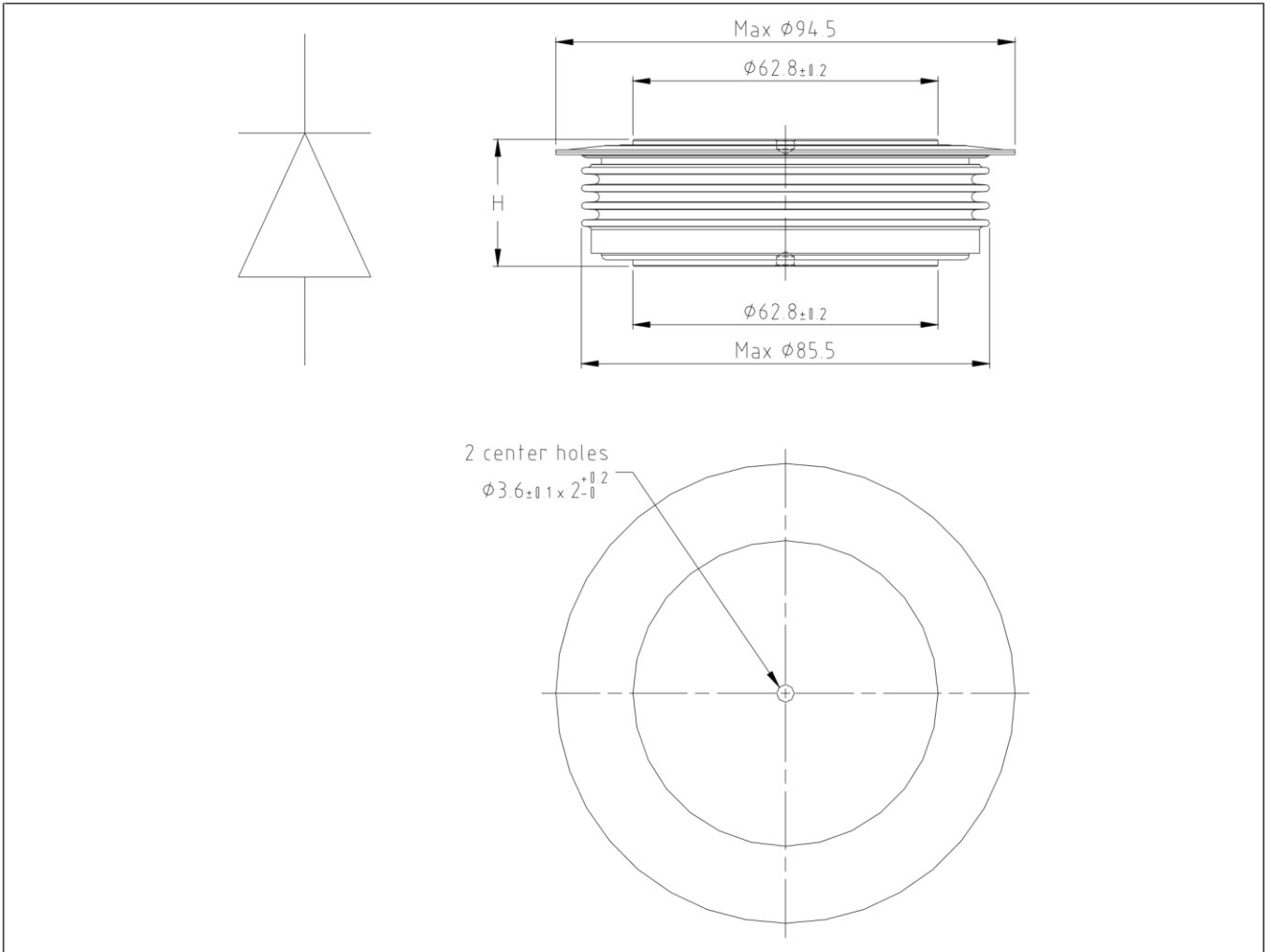


Fig. 12 Outline drawing, all dimensions are in millimeters and represent nominal values unless stated otherwise